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present studies on psychophysiology of brain reserves mechanisms and their activation. These reports will be presented:

"Predictors of the emotional and cognitive disturbances in prematurely born children" by Olga Ivanova, the influence of the gestational age, infection, brain damage, and stress during hospitalization on the emotional and cognitive development of the premature born children. "EEG cross-frequency correlations and stress sensitivity" by Gennady Knyazev, EEG cross-frequency amplitude-amplitude correlation (CF-AAC) as a potential marker of social anxiety and other affective disturbances. "Neuropsychological outcomes in children after COVID-19 infecting by Elena Nikolaeva", a decrease in the volume of working memory children after an infection. "Brain compensatory resources depending on the tumor localization in the anterior or posterior areas of the hemispheres" by Olga Razumnikova. "Neurophysiological correlates of postoperative cognitive disorders: The role of beta activity" by Irina Tarasova, EEG correlates of postoperative cognitive dysfunction induced by coronary artery bypass grafting. "The possibilities of physical training methods in the recovering of cognitive functions after cardiac surgery" by Olga Trubnikova, a short course of preoperative or postoperative physical training in the rehabilitation program in patients undergoing coronary artery bypass grafting can improve cognitive functioning after cardiac surgery.

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### EEG Cross-Frequency Correlations and Stress Sensitivity

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EEG cross-frequency amplitude-amplitude correlation (CF-AAC) has been considered as a potential marker of social anxiety and other affective disturbances. Functional significance of this phenomenon remains unclear, partly because the majority of studies used channel-level analysis, which precluded the spatial localization of observed effects. It is not also clear whether CF-AAC may serve as a marker of specific pathological conditions and specific states, or a more general predisposition to affective disturbances.

We used source-level analysis of EEG data obtained in resting conditions in a nonclinical sample and patients with major depressive disorder (MDD) and investigated associations of CF-AAC measures with a broad range of known risk factors for affective disorders, including age, gender, genotype, stress exposure, personality, and self-reported 'neurotic' symptomatology. A consistent pattern of associations showed that all investigated risk factors were associated with an enhancement of CF-AAC in cortical regions associated with emotional and self-referential processing. It could be concluded that CF-AAC is a promising candidate marker of a general predisposition to affective disorders at preclinical stages. The study was supported by the Russian Foundation for Basic Research (RFBR) under Grant № 20-013-00404.

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### The Possibilities of Physical Training Methods in the Recovering of Cognitive Functions After Cardiac Surgery

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The recovery of impaired cognitive functions after cardiac surgery is an unsolved medical and social problem. Greater attention is now being paid to the development of cognitive recovery methods. The aim of the study was to evaluate the possibilities of physical training (PT) methods to the recovering of cognitive functions in patients undergoing on-pump coronary artery bypass grafting (CABG). There were two sub-studies: the patients with a short preoperative course of PT and with postoperative aerobic exercise training. The study of preoperative PT included 33 male coronary artery disease patients, CABG-candidates, which were divided into 2 groups: with preoperative course of the PT (n=17) and without PT (n=16). The preoperative course of PT consisted of a 5–7-day course of intensive training on a treadmill. The study with postoperative aerobic exercise training enrolled 92 male patients, undergoing CABG, which also were divided into 2 groups: with supervised cycling training (n=39) and without cycling training program (n=53). The supervised regimen began 14 days postoperatively and included the three trainings per week. The patients with and without PT were comparable in the clinical and neuropsychological characteristics. The neurophysiological status (attention, short-term memory, executive function, and EEG power) was assessed before CABG and the preoperative PT course, also and at 7–10-th days after CABG and 1 month after, only for patients with postoperative aerobic exercise training. EEG and neuropsychological test data were statistically examined using STATISTICA 10.0 (StatSoft, USA). The patients with the preoperative PT had higher executive functions, greater indicators of attention and short-memory at 7–10 days after CABG in comparison to patients without training. Additionally, the patients with PT demonstrated a lower power in the theta (4–6 Hz) and beta1 (13–20 Hz) frequency ranges 7–10 days after CABG. The patients with postoperative exercise training demonstrated better attention and executive function at 1 month after CABG compared to the patients without cycling training. According to and electroencephalographic study, it was found that the patients who underwent the PT showed a lower percentage theta power increase at 1 month after CABG. Both the preoperative PT and three-week postoperative aerobic exercise training can produce beneficial effects on the postoperative neurophysiological status in CABG patients. The engagement of a short course of preoperative or postoperative PT in the rehabilitation program of CABG patients can improve cognitive functioning after CABG.

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### Neuropsychological Outcomes in Children After COVID-19 Infecting

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When analyzing the consequences of coronavirus disease, the media often argue that children can easily tolerate the disease. However, experts are very cautious about the data. This is primarily due to the available data on the consequences of the 1918 pandemic, which revealed a significant increase in Parkinson's disease 40 years after the illness in those who were children during the pandemic (Poskanzer, Schwab, 1963). More serious consequences for the nervous system of children after an illness may be associated with the fact that coronaviruses affects the developing nervous systems of infants, children, and adolescents (Bale, 2012). Based on data on the

influence of other types of coronaviruses, it is possible to argue that coronaviruses can cause nerve damage via diverse pathways (Y. Wu et al., 2020), including through severe acute demyelinating lesions developed after viral infections (Saad et al., 2014). In addition, the symptoms of infection are alarming: the fact is that hyposmia is observed 2-7 years before the onset of Parkinson's disease and serves as a marker of this disease (Ponseneta, 2004). Working memory determines movement in the direction of a consciously chosen target (Baddeley, 2000), while inhibitory control predetermines the suppression of irrelevant actions and thoughts (Cowan, 2005). Moreover, a change in these functions as a result of a disease can cause a second change in the emotional state. But the course of Parkinson's disease itself leads to a change in emotions. The purpose of the research was the analysis of neuropsychological outcomes in children after COVID-19 infecting. We have used the go/go and go/ no go paradigm for inhibitory control analysis and O. Razumnikova's method for working memory analysis. Results of the infecting and no infecting children were compared. Children after an infection (in the first 2-3 months) showed a marked decrease in the volume of working memory. This decrease is associated with an increase in the retrieval-induced forgetting mechanism (Anderson et al., 2011) and a decrease in the severity of the retrieval-based learning mechanism (Kramer et al., 2021). At the same time, no significant changes in the parameters of inhibitory control were found. Although both inhibitory control and working memory are associated with the prefrontal region of the brain, the consequences of coronavirus infection are different: working memory reacts immediately, while a delayed change in inhibitory control is possible. We propose to assess the neuropsychological state of children every six months for three years.

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### Neurophysiological Correlates of Postoperative Cognitive Disorders: The Role of Beta Activity

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The postoperative cognitive dysfunction (POCD) has come to occupy a leading position among the cognitive disorders in cardiosurgical patients. It would probably be useful to study the frequency-spatial rearrangements of brain activity associated in the postoperative period of cardiac surgery. The study aimed to investigate the low- (theta, alpha1) and high-frequency beta-2 activity patterns associated with postoperative cognitive dysfunction (POCD) in patients after coronary artery bypass grafting (CABG).

The study included 60 patients who underwent neuropsychological testing 3–5 days before surgery and on the 7–10th day of CABG and was recorded a multichannel electroencephalogram of resting state with eyes closed in 62 standard leads. Statistical processing of the psychometric and EEG data was carried out both by the ANOVAs using STATISTICA 10 software and by the developed method of data clustering with a minimax criterion using a software implementation of the binary clipping and branching algorithm to find optimal solutions. It was found that patients with POCD had higher pre- and postoperative high-frequency beta-2 rhythm power (20-30 Hz) compared with patients without cognitive decline. The regression model demonstrated that POCD associated with high values of preoperative beta-2 activity in the right frontal cortex and low - in the left parietal areas after CABG. The clustering of EEG power before and after CABG revealed that the beta-2 rhythm is the best predictor of higher score of complex indicator of cognitive status (a summary characteristic of the functions of attention,

and memory) cognitive status corresponding to a stable affiliation of patients with the selected clusters. The specific EEG correlates in the beta2 frequency range associated with POCD were established in the patients after CABG. The cognitive status was characterized by the rearrangements of the high-frequency oscillations in the right frontal and left parietal cortex. The developed method for classifying patients according to the level of pre- and postoperative beta-2 rhythm power has a good discriminant ability. Stable patient affiliation with the selected clusters was associated with a higher level of cognitive status, i.e. hypothetically, with involvement of cognitive reserves of the brain.

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### Brain Compensatory Resources Depending the Tumor Localization in the Anterior or Posterior Areas of the Hemispheres

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The slow growth of tumors give the opportunity to study the brain neuroplastic potential in a pathophysiological model, and this may help to reveal critical brain systems for new functional adaptation or functional damage which will never can to be recover. To understand the mechanisms of such compensation and its role in the self-assessment of the quality of life, an analysis of the cognitive-emotional status depending on the location and type of tumors in the preoperative period was performed. The study involved 62 patients of the neurosurgical clinic and 40 healthy people as the control group. The age, education, and proportions of men and women in the groups did not differ significantly. The criteria for including patients for psychometric testing were tumour location in the frontal or parietal regions of the left or right hemisphere using tomographic methods with contrast agents. The diagnosis of type and grade of the tumours was based on histological analysis. In the preoperative period, the patients performed the intelligence, creative, and personality testing and assessed the physical (QoLphys) and mental (QoLpsy) health by the Short Form Health Questionnaire (SF-36). All patients noted a decrease in QoL, especially the indicators of role (RP) and emotional (RE) functioning (Fig. 1). QoL was impaired more due to the left hemisphere damage. When the right frontal region is affected, a higher integral indicator of mental health corresponded to increased figurative fluency. In case of damage to the right parietal region, a positive relationship was noted between the QoLpsy and figurative fluency, but the reverse one with neuroticism (Fig.2 A), while for the QoLphys a positive relationship was significant also with IQ (Fig.2 B). An analysis of the changes in cognitive functions depending on the type of tumor did not reveal significant differences. The lowest self-assessment of the QoL was characteristic for patients with metastases. So, it can be concluded that self-assessment of the quality of life in the patients with brain damage by a tumor depends not only on its type, but also on localization. Cognitive functions, namely the intelligence and fluency of generating ideas as the index of figural creativity are psychometric indicators of the compensatory resources of the brain when it is damaged. Disruption of the relationship between cognitive functions and self-assessment of quality of life are more to occur due to damage to the left frontal part.

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